Porous Pavement

Porous Pavement Location at COC

Figure 1
Porous Pavement Location at COC

Figure 2
Stormwater Porous Pavement Area at COC

Pre-Construction

Figure 3
Porous Pavement Location
at COC

Figure 4
Porous Pavement Location
at COC

Figure 5
Porous Concrete Location
at COC

Construction - Demolition

Figure 6
Asphalt Demolition

Figure 7
Ground Asphalt for Recycling

Figure 8
Concrete Demolition

Construction - Grading

Figure 9
Grading for Porous Pavement Installation

Figure 10
Berms for Terraced Reservoir under Porous Asphalt

Figure 11
Scarified Soil at Bed Bottom

Construction – Stone Reservoir

Figure 12
Delivering Aggregate for Porous Pavement Reservoir

Figure 13
Grading of Aggregate over Fabric

Figure 14
Grading Aggregate and Immobile Roller

Aggregate for Reservoir

Figure 15
Suitable Washed and Sized Aggregate

Figure 16
Unsuitable, Unclean, and Inconsistent Aggregate

Figure 17
Aggregate for Porous Pavement Reservoir

Construction - Porous Concrete

Figure 18
Porous Concrete Forms with Choker Course

Figure 19
Application of Porous Concrete

Figure 20
Covering Concrete with Visqueen

Construction - Porous Concrete

Figure 21
Application of Concrete

Figure 22
Second Day Concrete Curing

Figure 23
Porous Concrete Profile

Construction - Porous Asphalt

Figure 24
Applying Porous Asphalt Adjacent to Existing Asphalt

Figure 25
Application by Tracked Paver

Figure 26
Testing Porous Asphalt

Porous Pavement Sections

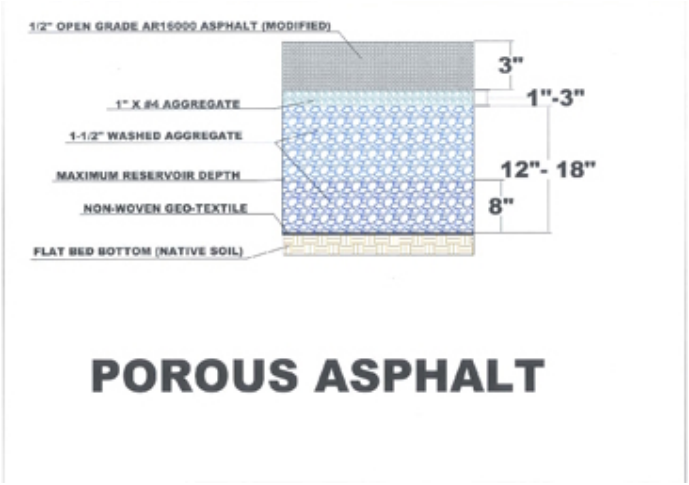

Figure 27
Porous Asphalt Section

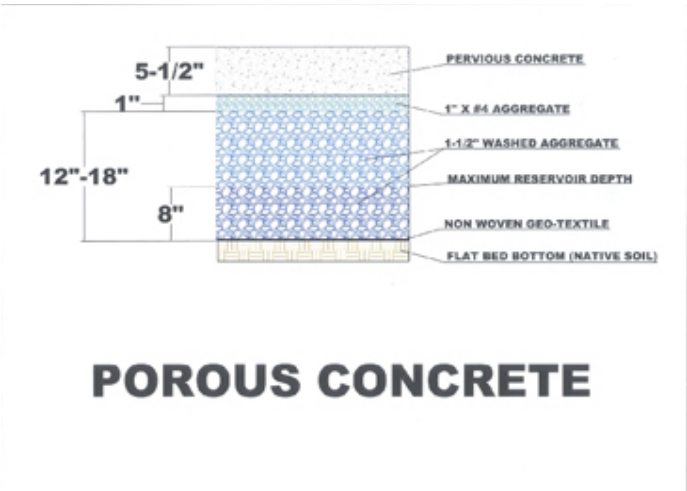

Figure 28
Porous Concrete Section

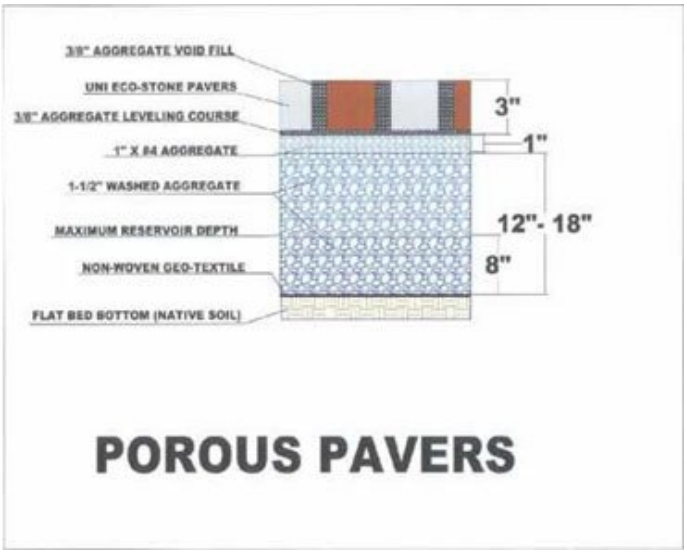

Figure 29
Porous Pavers Section

Monitoring Porous Paving

Targeted Pollutants of Concern

- Suspended Solids
- Oil/Grease
- Heavy Metals (Copper, Zinc, Chromium, Cadmium)
- Organics
- Nitrogen

Figure 30

Figure 31
Installation of Monitoring Catch Basins

Figure 32
Catch Basin with Weir

Monitoring Porous Paving

Figure 33
Thel-Mar Weir for
Measuring Overflow
Volume from Reservoir

Figure 34
Construction of Monitoring
Vault for Reference Area

Figure 35
Fiberglass Flume Insert in
Monitoring Vault for
Reference Area

Post - Construction

Figure 36
Paved Asphalt and
Concrete Area

Figure 37
Moving Vehicle

Figure 38
Stationary Vehicle

Post - Construction

Figure 39
Rain Event

Figure 40
Rain Event

Figure 41
Rain Event

Cost Summary

PAVEMENT REPLACEMENT SQUARE FOOT COSTS 2005						
	Demolition & Excavation	Installation of Sub Base	Pavement Costs	Square Foot Costs*	Annual Est. Square Foot Maintenance Costs	Comments
Porous Asphalt	$ 2.75	$ 1.88	$ 1.87	$ 6.50	$ 0.04	18" excavation/backfill. 3" porous asphalt.
Standard Asphalt	$ 2.13	$ 1.04	$ 1.32	$ 4.49	$ 0.06	6"-Excavation/Backfill. 6"-Asphalt.
Porous Concrete	$ 3.19	$ 1.88	$ 6.34	$ 11.41	$ 0.02	18"-Excavation/Backfill. 5-1/2" pervious concrete.
Standard Concrete	$ 1.51	$ -	$ 3.42	$ 4.93	$ 0.01	No new base material. 6"-Reinforced Concrete
Porous Pavers	$ 2.75	$ 1.88	$ 9.63	$ 14.26	TBD	18"-Excavation/Backfill. 3"-Paver.
*Square foot cost are based on actual cost received by the County of San Diego.						

Cost Summary

County of San Diego Department of General Services		
Porous Pavement Construction Cost		
Description	**Construction Cost**	**Comments**
Mobilization & Site Security	$15,000.00	
Surveying	$5,000.00	County Surveyed
Demolition & Excavation	$120,000.00	
Hauling & Disposal	$62,000.00	
Rough & Fine Grading	$17,000.00	
Piping & Catch Basins	$76,000.00	
Modify Flume & Catch Basins	$19,000.00	
Fabric & Waterproof Membrane	$15,000.00	
Backfill	$118,500.00	
Asphalt	$74,500.00	
Concrete	$95,000.00	
Pavers	$80,500.00	
Asphalt patching & Berms	$22,000.00	
JOC/Purchasing Fees	$20,500.00	
	Total Construction Cost	**$740,000.00**
4/6/2006		

Treatment Train

Treatment Train

Figure 42
COC Site Plan

Figure 43
Stormwater Treatment Units Work Area at COC

Pre-Construction

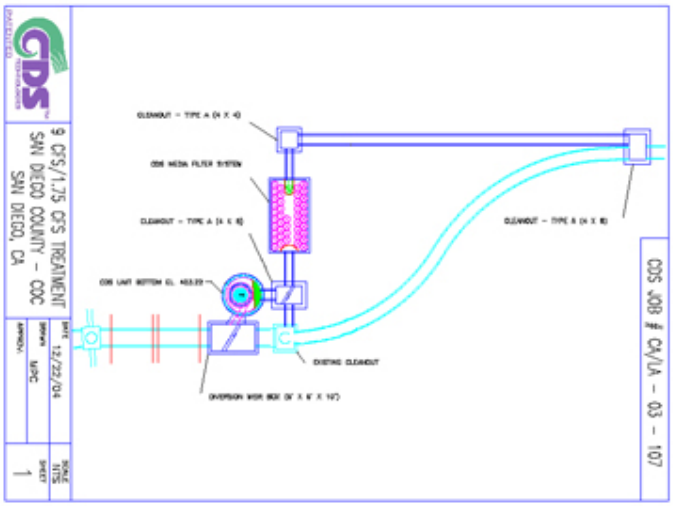

Figure 44
CDS Diagrammatic Spec

Figure 45
Site Secured for Construction

Figure 46
Mobilization for Construction

Pre-Construction

Figure 47
Mobilization for Construction

Figure 48
Rain Event at Mobilized Site

Figure 49
Rain Delay

Construction - Continuous Deflection Separator

Figure 50
Shoring for CDS Unit

Figure 51
Pre-Cast CDS Units

Figure 52
Bottom of CDS Sump Installed

Construction - Continuous Deflection Separator

Figure 53
CDS Deflector Screen

Figure 54
CDS Outer Shell and Deflector Screen

Figure 55
Stabilizing CDS Unit with Slurry

Construction – Media Filtration System

Figure 56
Installing MFS Vault

Figure 57
Installing MFS Components

Figure 58
MFS Vault with Pre-Fabricated Access Risers

Construction – Media Filtration System

Figure 59
Perlite Filter Canisters

Figure 60
Perlite Filter Canister

Figure 61
Perlite Filter Media

Post - Construction

Figure 62
Debris in CDS Unit After Storm Event

Figure 63
MFS Canisters in January 2006

Figure 64
MFS Canisters in January 2006

Post - Construction

Figure 65
Operating MFS Unit
(Canisters Covered and
Bypass Discharge)

Figure 66
Flow Monitoring Equipment
Upstream of CDS Unit
(Combined Doppler and
Bubbler Sensors)

Figure 67
Flow Control Structure
Between CDS and MFS
Units

Monitoring

Monitoring

Targeted Pollutants of Concern

- Suspended Solids
- Oil/Grease
- Heavy Metals (Copper, Zinc, Chromium, Cadmium)
- Organics
- Nitrogen

Figure 68
Pollutants of Concern

Figure 69
Confined Space Entry to Install Monitoring Equipment

Figure 70
CDS Monitoring Equipment

Monitoring

Figure 71
Monitoring Station

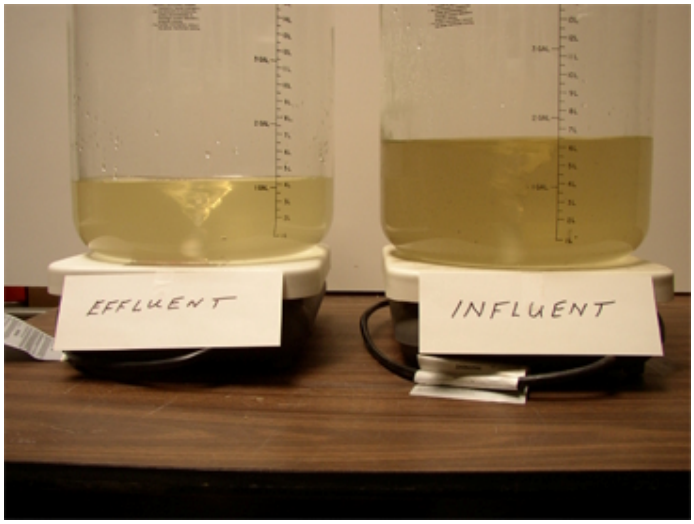

Figure 72
Media Filtration System - Influent/Effluent Results

Figure 73
Above Ground Monitoring Equipment and Rain Gauge

Cost Summary

Treatment Train Actual Retrofit Costs		
Description	**Model**	**Construction Cost**
*Purchase Pre-treatment Unit	CDS PSWC56 (7cfs)	**$ 46,000.00**
*Purchase Filtration Unit	CDS 816 42 filters (1.75cfs)	**$ 67,000.00**
*Included System Design	**Total Purchased**	**$ 113,000.00**
Contract Cost Breakdown		
Mobilization & Site Security	$15,000.00	
Surveying	$9,500.00	
Excavation	$39,000.00	
Hauling & Disposal	$34,000.00	
Site Safety/Shoring	$15,000.00	
Piping	$17,000.00	
Diversion wiers & boxes	$35,000.00	
Install Treatment Train Units	$21,000.00	
Slurry backfill	$39,000.00	
Surface Repairs	$44,000.00	
JOC/Purchasing Fees	$8,500.00	
	Total	**$277,000.00**
	Total Construction Cost	**$390,000.00**